In the Claims:

The claims are presented herewith. Please cancel claims 1-42 and replace them with the following claims 43-83. It is not necessary to include a "Version with Markings to show Changes Made" for the claims in this Amendment After Final Action, as the claims have been cancelled and replaced with new claims 43-83.

43. At least one of an imaging and raster-mode scanning apparatus, having

a beam generator,

a scanner that deflects at least one of the beam and scans an object,

a sample acceptor for accepting the object, and, optionally, a deflector that deflects the sample acceptor, and

a compensator that compensates for ambient influences that may degrade an imaging of the object, comprising:

an image acquirer that acquires at least one of at least one pixel of an image of the object and of a predetermined reference object,

an image processor that is connected downstream of the image acquirer,

an image display device,

an electrical filter with a signal input and a calibration input,

at least one sensor that provides a first signal dependent on the ambient influences,

and at least one of an actuator and a control element, wherein

the electrical filter has a settable transfer characteristic that can be set by applying a second signal to a calibration input of the electrical filter to effect the apparatus into a calibrated state, wherein ambient influences detected by the at least one sensor are

compensated such that image degradations acquired by the image acquirer are greatly reduced or essentially compensated, and

wherein the first signal dependent on the ambient influences passes through the electrical filter and drives at least one of an internal actuator and internal control elements of the apparatus to control the scanner or the sample acceptor to compensate the ambient influences that has an effect on at least one of the imaging and on an image display acquired by the image acquirer.

44. The apparatus according to claim 43, wherein the at least one sensor is adapted to detect at least one physical quantity outside the apparatus, and to output the first signal that depends on the ambient influences at the location of the at least one sensor.

45. The apparatus according to claim 44, wherein the at least one sensor comprises at least one pick-up for electromagnetic fields, magnetic fields, air vibrations and ground vibrations.

46. The apparatus according to claim 43, wherein the electrical filter comprises a signal input that is connected to an output of the image processor that is connected upstream of the image acquirer for acquiring the at least one pixel of an object.

47. The apparatus according to claim 43, further comprising a calibrator that manually calibrates the filter.

48. The apparatus according to claim 43, wherein the control elements are arranged in the image processing device.

49. The apparatus according to claim 43, wherein an output of the image processor is connected to a calibration input of the electrical filter.

50. The apparatus according to claim 43, wherein the second signal varies as a function of at least one of scanning position of the beam and of time controlled by the scanner.

51. The apparatus according to claim 44, wherein the apparatus operates in a calibration mode and subsequently operates in an image mode, whereby, in the calibration mode, ambient influences that degrade the image are detected by comparison of the image of the predetermined reference object under ambient influences with an image of a real structure of the reference object in the image processor, and

wherein the comparison results in a difference representing an image defect being assigned to the second signal being formed and output to the calibration input of the electrical filter for setting the transfer characteristic, and

whereby by calibration of the electrical filter ambient influences that degrade the image are greatly reduced or essentially compensated for, and

whereby the image defects are compensated for by maintaining the calibration in the image mode, even in the event of a change in the ambient influences.

52. The apparatus according to claim 41, wherein in the calibration mode:

the scanner scans a selected section of the reference object,

the image processor compares a stored signal assigned to the reference object with an image signal of the reference object under ambient influences, the image signal having been obtained from the image acquirer,

whereby in the image processor a defect signal is formed which is assigned to the difference resulting from the comparison between the stored signal and the image signal and which the image processor outputs to the electrical filter, and

the apparatus stores, in a memory, data for generating the second signal for setting the transfer parameters of the electrical filter for the image mode.

53. The apparatus according to claim 51, wherein in the image mode:

the scanner scans the object to be imaged, and

the apparatus, taking the data stored during the calibration mode as a basis, generates the second signal for defining the transfer parameters of the electrical filter on said basis for compensation of the image defects during the scan.

54. The apparatus according to claim 44, wherein the apparatus is set up for automatically calibrating the electrical filter during an image mode.

55. The apparatus according to claim 54, wherein the image is adapted to scan the object to be imaged and the image processor is set up for determining a temporal displacement of line centroids of successive image lines scanned within the whole image by the image acquirer and outputs the second signal as a function of this temporal displacement to the electrical filter.

56. The apparatus according to claim 55, wherein the image processor is set up for determining a temporal displacement of the image centroids of successive images scanned by the image acquirer and outputs the second signal as a function of this temporal displacement to the electrical filter.

57. The apparatus according to claim 54, wherein the electrical filter is set up for carrying out a cross-correlation of the first signal and of the second signal.

58. The apparatus according to claim 43, wherein the apparatus is set up for reducing or compensating for the image degradation in two mutually orthogonal directions.

59. The apparatus according to claim 14, wherein the apparatus comprises a scanning electron microscope, a force microscope, a surface roughness measuring instrument, an optical scanning microscope, a light microscope, a transmission electron microscope or a lithography installation.

60. The apparatus according to claim 59, wherein in the case of the electron microscope, an actuator comprises at least one of a deflector for deflecting an electron beam and a displacer that displaces the sample.

61. The apparatus according to claim 59, wherein the case of the light microscope, an actuator comprises a deflector device for deflecting light or a displacer that displaces a sample.

62. The apparatus according to claim 46, wherein the apparatus comprises a light microscope or a transmission electron microscope, wherein the image acquirer and the image processor functions as one of the at least one sensors, and wherein the image processor outputs the first signal as a function of the temporal displacement that is determined.

63. A method for operating an imaging or raster-mode scanning apparatus for compensating ambient influences that may degrade the imaging, comprising the steps of:

providing a first signal dependent on the ambient influences,

passing the first signal directly through an electrical filter with a settable transfer characteristic which can be set by applying a second signal to a calibration input of the electrical filter,

providing an output signal of the electrical filter,

driving an internal actuator or an internal control element of the apparatus with the output signal of the electrical filter, which has an effect on the imaging or the image display of

an image acquirer that acquires at least one pixel of an image of an object or of a predetermined reference object in the course of imaging or scanning,

effecting the apparatus into a calibrated state, by applying said second signal to the calibration input of the electrical filter for setting the transfer characteristic, such that the image degradation acquired by the image acquirer is greatly reduced or essentially compensated for.

64. The method according to claim 634, wherein the calibration of the apparatus is carried out by manual setting of the electrical filter.

65. The method according to claim 63, wherein a control element in the image processor is driven and the compensation of the image degradation is carried out at least partially in the image processor.

66. The method according to claim 63, wherein an actuator in the scanner is driven and the compensation of the image degradation is carried out at least partially by driving the actuator of the scanner.

67. The method according to claim 63, wherein the apparatus is operated in a calibration mode and subsequently in an image mode, whereby

ambient influences that degrade the imaging are detected by means of a sensor which is arranged outside the apparatus and drives a signal input of the electrical filter,

in the calibration mode, the degeneration of the image is greatly reduced or essentially compensated for by an imaging of a predetermined reference object under ambient influences and a comparison of the image of the reference object with the image of the real structure of the reference object and by calibration of the transfer characteristic of the filter, and

in the image mode, the degradation of the image is at least partially compensated for by maintaining the calibration, even in the event of a change in the ambient influences.

68. The method according to claim 67, wherein the calibration mode comprises at least the following steps:

determination of the first signal which depends on the interfering ambient influence at the location of the sensor, by the sensor arranged outside the apparatus;

application of the first signal to the signal input of the filter;

acquisition of a selected section of the predetermined reference object by the image acquirer by the scanning of the reference object under ambient influence;

comparison of the acquired selected section of the reference object under ambient influences with the real structure of the reference object; and

determination of a defect signal assigned to a difference which results from the comparison;

application of the second signal, derived from the defect signal, to the regulating input of the electrical filter for defining the transfer characteristic of the electrical filter;

application of the output signal of the electrical filter to the signal input of a regulating amplifier;

application of the output signal of the regulating amplifier to an actuator or a control element to control an internal scanner for deflecting a beam or scanning an object or for deflecting a sample acceptor that accepts the object or reference object for the purpose of correcting the degraded image quality;

iterative calibration of the characteristic of the electrical filter, in such a way that the reduction of the imaging quality is greatly reduced or essentially compensated for, by means of the following steps:

comparison of the corrected image of the reference object under ambient influence with the real structure of the reference object,

alteration of the characteristic of the electrical filter in such a way that the corrected image approximates to the real structure of the reference object,

storage of data determined by iterative calibration for providing the transfer characteristic of the filter for the image mode.

69. The method according to claim 67, wherein in the image mode, an image of the object is acquired by scanning, the characteristic of the electrical filter of the apparatus that has been determined in the calibration mode being fixedly prescribed, and the output signal of the electrical filter, which is a digital filter, after passing through a regulating amplifier, is assigned to the actuator or the control element, with the result that the ambient influences that degrade the imaging of the object acquired by the scan are greatly reduced or essentially compensated for even in the event of a change in the ambient influences.

70. The method according to claim 63, wherein

ambient influences which impair the imaging of the image acquirer are detected by means of the sensor, which is arranged outside the apparatus and drives the signal input of the electrical filter which is a digital filter, with the first signal,

the image acquirer feeds its acquired image signal to an image processor, in which an image analysis of the image acquired by the image acquirer is carried out and a signal

dependent on the analysis is applied as the second signal dependent on the analysis is applied as the second signal to the calibration input of the electrical filter,

the output of the electrical filter is applied via a regulating amplifier to the actuator or the control element of the apparatus, which has an effect on the image, the image degradation thereby being greatly reduced or essentially compensated for.

71. The method according to claim 70, wherein

an object to be imaged is scanned by the image acquirer,

the image analysis comprises a recursive determination of a temporal displacement of line centroids of successive image lines within the whole image of the object scanned by the image acquirer, whereby

the second signal is calculated from the temporal displacement.

72. The method according to claim 70, wherein

the image analysis comprises a recursive determination of a temporal displacement of image centroids of successive image acquired by the image acquirer, and

the second signal is calculated from the temporal displacement.

73. The method according to claim 71, wherein essentially a cross-correlation of the first signal with the second signal is carried out in the electrical filter and, consequently, the actuator or the control element is fed with a drive signal which is dependent on the cross-correlation between the first signal and the second signal.

74. The method according to claim 63, comprising the steps of

feeding an image processor with an image signal of the image acquirer acquired from the image;

analyzing the image signal in the image processor; and

applying a signal dependent on the result o the analyzing step as the first signal to a signal input of the filter; and

applying a signal dependent on the result of the analyzing step as the first signal to a signal input of the filter; and

applying a signal dependent on the result of the analyzing step as the second signal to a signal input of the filter; and

applying the output of the electrical filter via a regulating amplifier to the actuator via an element of the apparatus, which has an effect on the imaging, the imaging degradation thereby being greatly reduced or essentially compensated for.

75. The method according to claim 74, wherein the analyzing of the image acquired by the image acquirer comprises a recursive determining of a displacement of line centroids of successive image lines within the whole acquired image or the recursive determination of the displacement of the image centroid of successive images.

76. The method according to claim 63, wherein the image degradation is essentially compensated for by means of the actuators or the control elements acting in two mutually orthogonal directions.

77. An apparatus for compensating for ambient influences in imaging or raster-mode scanning apparatuses that may degrade the imaging with an image acquisition and an image processing device, comprising

a calibratable digital electrical filter with a signal input and a calibration input;

a regulating amplifier which is electrically connected downstream of the electrical filter,

an internal control element controlled by the regulating amplifier;

wherein a first signal dependent on the ambient influences is applied to the signal input of the electrical filter which generates a signal at the output of the electrical filter, and

wherein a second signal is applied to the calibration input of the electrical filter to calibrate the electrical filter, and

wherein the internally controlled control element has an effect on the image acquired by the image acquisition and an image processor,

whereby in the calibrated state of the electrical filter, the image degradation is greatly reduced or essentially compensated for.

78. The apparatus according to claim 77, further comprising at least one sensor for detecting at least one physical quantity outside the apparatus, this sensor outputting the first signal which is dependent on the ambient influences at the location of the sensor.

79. The apparatus according to claim 49, wherein the apparatus is designed for operation in a calibration mode and for subsequent operation in an image mode, whereby, in the calibration mode, ambient influences which degrade the image are detected by the comparison of the image of the predetermined reference object under ambient influences with an image of the real structure of the reference object in the image processor,

wherein the comparison results in a difference representing an image defect being assigned to the second signal being formed and output to the calibration input of the electrical filter for setting the transfer characteristic,

whereby by calibration of the electrical filter ambient influences which degrade the image are greatly reduced or essentially compensated for, and

whereby the image defects are compensated for by maintaining the calibration in the image mode, even in the event of a change in the ambient influences.

80. The apparatus according to claim 49, wherein the apparatus is set up for automatically calibrating the electrical filter during the image mode.

81. The apparatus according to claim 49, wherein the apparatus comprising a light microscope or a transmission electron microscope, the first signal also being determined from the temporal displacement that is determined.

82. The apparatus according to claim 56, comprising a light microscope or a transmission electron microscope, the first signal also being determined from the temporal displacement that is determined.

83. The apparatus according to claim 46, for operation in a calibration mode and subsequently operable in an image mode, whereby, in the calibration mode, ambient influences which degrade the image are detected by the comparison of the image of the predetermined reference object under ambient influences with an image of the real structure of the reference object in the image processor,

wherein the comparison results in a difference representing an image defect being assigned to the second signal being formed and output of the calibration input of the electrical filter for setting the transfer characteristic,

whereby by calibration of the electrical filter ambient influences which degrade the image are greatly reduced or essentially compensated for, and

whereby the image defects are compensated for by maintaining the calibration in the image mode,

even in the event of a change in the ambient influences.

Other Claims

The other claims are not anticipated or obvious in view of the prior art, and therefore are patentable.

Amendments to Claims 46 and 48

Claim 46 (old claim 4): On the basis of new claim 43 (old claim 1), old claim 4 should also be clarified. As mentioned above, it is the image acquisition device (acquirer) that picks up the image and the image degradations if there are any, whereby the acquired data are processed in the image processing device (processor). In this way, the image acquirer acts as a kind of sensor of the image disturbances, also.

Claim 48 (old claim 6): Claim 48 (old claim 6) refers to claim 43. In claim 43, as in the originally filed claim 1, the control element as well as the image processor are defined. Therefore, these terms no longer lack a proper antecedent basis.

Claims 49 and 51: Old claim 7 is not included in the new claims, as it is now included in new claim 43 (old claim 1).

Claim 51 (old claim 9) has been changed to reflect that the scan is carried out within the beam and the scanner (scanning device) as defined in new claim 43.

Claim 50 refers to claim 43 and is now clear, since new claim 43 clearly defines that the filter comprises two inputs, namely one for calibration and one signal input.

Claims 52 and 53: Claim 52 has been rewritten from old claim 10, in which it has been made clear that the image defects result from the comparison, and that on the basis of the defects, the second signal is formed, which is used for calibrating the filter, whereby the calibration leads to an appropriate transformation of the signal that originates from ambient influences, and that is

input into the signal input of the filter, so as to form an output signal of the filter, which controls the control elements in a manner that compensates the ambient influences.

Moreover, it has been emphasized that the comparison has been carried out by comparing a reference object under ambient influences with one that is supposed to be free from ambient influences and therefore represents the real structure of the reference object. Thus, for clarification, the image of the reference object under ambient influences and the image of the real structure of reference objects have been put in opposition to each other in the claim.

Claim 53 depends from claim 51, which defines the "real structure" in comparison to the reference object under ambient influences. Therefore, claim 53 now refers to the "real structure" of claim 51.

Claim 54 makes the functionality of the scanning device in the context of the invention clear.

Claim 55, 56 and 63: Claim 55 describes the possibility that the scan according to the invention can also be performed by the imager (image acquisition device) directly, whereby on the basis of the scan the image processing device determines a temporal displacement of line centroids of successive image scanned within the whole image by the image acquirer, of which basis the second signal is generated.

Claim 56 refers to claim 55, which defines that the scan takes place in the image acquisition device. Claim 56 should also be clear now. The image centroids refer to the images scanned successively.

Claim 62 refers to an embodiment according to Fig. 1d. Therefore, it has been made clear that the image acquisition device and the image processing device functions as one of the at least one sensors, whereby the first signal is determined by the processing device. This has been

done in accordance with claim 55 wherein the processing device is set up for determining a temporal displacement of line centroids.

Claim 63 has been rewritten similarly to claim 43. Thus, it has been made clear that the imaging takes place in the image acquirer, which detects a possible deterioration on the image in the course of imaging or scanning.

Claims 67 and 76: Claim 67 has been amended in the same manner as claims 52 and 53. Thus, for clarification, the image of the reference object under ambient influences, and the image of the real structure of reference objects have been put in opposition to each other in the claim.

Claim 68 includes the term "interfering ambient influences" that replaces the term "interfering influences" to clarify that these influences have the same origin. Moreover, the amendments with regard to the "real structure" of claim 67 (old claim 26) have been replaced here, also. Additionally, it has been clarified that the internal actuator and/or the control element have the purpose of controlling a scanning device for deflecting a beam and/or scanning an object and/or for deflecting a sample acceptance means for accepting the object or reference object.

Claim 69 makes it clear that in the image mode an image is acquired via a scan. Further the term "image defects" has been replaced by the expression "the ambient influences that degrade the imaging of the object acquired by the scan" to adapt the terminology to former claims, for the sake of clarification.

Claim 70 refers to clarified claim 63, in which it is stated that the image acquirer (image acquisition device) acquires an image. In claim 70, this image is taken and analyzed, whereby from the image acquirer the acquired image signal is fed to the image processor (processing

device), in which an image analysis of the image acquired by the image acquisition device is carried out.

Claim 71: Claim 71 depends from claim 70 and has been rewritten for clarification.

Claim 73 makes clear that the image originates from the image acquirer (acquisition device), as has already been made clear by new claim 63.

Claim 77 has been changed in the same way as claim 43.

Claims 79 and 83 have been amended in the same manner as claim 53.

This Amendment after Final Action is necessary to place the claims in condition for allowance or in better condition for appeal. Specifically, applicant has amended the claims in response to the questions raised by the Examiner in the Final Action and thereafter and to include the changes the Examiner suggested in the Final Action.